

CLAIMS

What is claimed is:

- 1 1. An optical apparatus, comprising:
- 2 a) an input port, providing a multi-wavelength optical signal;
- 3 b) a polarization-separating element that decomposes said multi-wavelength
- 4 optical signal into first and second polarization components;
- 5 c) a polarization-rotating element that rotates a polarization of said second
- 6 polarization component by approximately 90-degrees;
- 7 d) a wavelength-disperser that separates said first and second polarization
- 8 components by wavelength into first and second sets of optical beams,
- 9 respectively; and
- 10 e) an array of optical power sensors, positioned to receive said first and second
- 11 sets of optical beams.
- 1 2. The optical apparatus of claim 1 further comprising an auxiliary polarization-rotating
- 2 element, such that said first and second sets of optical beams are polarized in two
- 3 orthogonal directions upon impinging on said array of optical power sensors.
- 1 3. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element
- 2 is disposed between said wavelength-disperser and said array of optical power
- 3 sensors.
- 1 4. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element
- 2 is configured such that said second set of optical beams undergoes a rotation in
- 3 polarization of approximately 90-degrees.
- 1 5. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element
- 2 is configured such that said first set of optical beams undergoes a rotation in
- 3 polarization of approximately 90-degrees.

1 6. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element
2 comprises an element selected from the group consisting of half-wave plates, Faraday
3 rotators, and liquid crystal rotators.

1 7. The optical apparatus of claim 1 wherein said polarization-separating element
2 comprises an element selected from the group consisting of polarizing beam splitters
3 and birefringent beam displacers.

1 8. The optical apparatus of claim 1 wherein said polarization-rotating element comprises
2 an element selected from the group consisting of half-wave plates, Faraday rotators,
3 and liquid crystal rotators.

1 9. The optical apparatus of claim 1 wherein said array of optical power sensors
2 comprises a photodiode array.

1 10. The optical apparatus of claim 1 wherein said wavelength-disperser comprises an
2 element selected from the group consisting of ruled diffraction gratings, holographic
3 gratings, echelle gratings, curved diffraction gratings, transmission gratings, and
4 dispersing prisms.

1 11. The optical apparatus of claim 1 further comprising a beam-focuser for focusing said
2 first and second sets of optical beams into corresponding focused spots.

1 12. The optical apparatus of claim 11 wherein said beam-focuser comprises at least one
2 focusing lens.

1 13. The optical apparatus of claim 1 wherein said input port comprises a fiber collimator.

1 14. An optical apparatus, comprising:

2 a) an input port, providing a multi-wavelength optical signal;

- 3 b) a polarization-separating element that decomposes said multi-wavelength
4 optical signal into first and second polarization components;
5 c) a polarization-rotating element that rotates a polarization of said second
6 polarization component by approximately 90-degrees;
7 d) a wavelength-disperser that separates said first and second polarization
8 components by wavelength into first and second sets of optical beams
9 respectively; and
10 e) an array of optical power sensors, positioned to receive said first and second
11 sets of optical beams;

12 wherein said optical apparatus further comprises a modulation assembly, which is
13 adapted to modulate said first and second sets of optical beams prior to impinging
14 onto said array of optical power sensors.

1 15. The optical apparatus of claim 14 wherein said modulation assembly is adapted to
2 cause said first and second sets of optical beams to impinge onto said array of optical
3 power sensors in a time-division-multiplexed sequence.

1 16. The optical apparatus of claim 15 wherein said modulation assembly comprises first
2 and second shutter-elements.

1 17. The optical apparatus of claim 16 wherein said first shutter-element comprises an
2 element selected from the group consisting of liquid crystal based shutter elements
3 and MEMS based shutter elements.

1 18. The optical apparatus of claim 17 wherein said second shutter-element comprises an
2 element selected from the group consisting of liquid crystal based shutter elements
3 and MEMS based shutter elements.

1 19. The optical apparatus of claim 16 further comprising a control unit, in
2 communication with said first and second shutter-elements.

- 1 20. The optical apparatus of claim 14 wherein said modulation assembly comprises first
2 and second modulating elements, adapted to cause said first and second sets of optical
3 beams to carry distinct dither modulation signals upon impinging onto said array of
4 optical power sensors.
- 1 21. The optical apparatus of claim 20 wherein said first modulating element comprises an
2 electro-optic intensity modulator.
- 1 22. The optical apparatus of claim 21 wherein said second modulating element comprises
2 an electro-optic intensity modulator.
- 1 23. The optical apparatus of claim 20 further comprising a control unit, in
2 communication with said first and second modulating elements.
- 1 24. The optical apparatus of claim 20 further comprising a synchronous detection unit,
2 configured to detect said dither modulation signals.
- 1 25. The optical apparatus of claim 14 wherein said modulation assembly comprises an
2 optical beam-chopper.
- 1 26. The optical apparatus of claim 14 wherein said modulation assembly is in optical
2 communication with said polarization-separating element along with said
3 polarization-rotating element and said wavelength-disperser, thereby controlling said
4 first and second polarization components.
- 1 27. The optical apparatus of claim 14 wherein said modulation assembly is in optical
2 communication with said wavelength-disperser and said array of optical power
3 sensors, so as to control said first and second sets of optical beams.

- 1 28. The optical apparatus of claim 14 wherein said polarization-separating element
2 comprises an element selected from the group consisting of polarizing beam splitters
3 and birefringent beam displacers.
- 1 29. The optical apparatus of claim 14 wherein said polarization-rotating element
2 comprises an element selected from the group consisting of half-wave plates, Faraday
3 rotators, and liquid crystal rotators.
- 1 30. The optical apparatus of claim 14 wherein said array of optical power sensors
2 comprises a photodiode array.
- 1 31. The optical apparatus of claim 14 wherein said wavelength-disperser comprises an
2 element selected from the group consisting of ruled diffraction gratings, holographic
3 gratings, echelle gratings, curved diffraction gratings, transmission gratings, and
4 dispersing prisms.
- 1 32. The optical apparatus of claim 14 wherein said input port comprises a fiber
2 collimator.
- 1 33. The optical apparatus of claim 14 further comprising a beam-focuser for focusing
2 said first and second sets of optical beams into corresponding focused spots.
- 1 34. The optical apparatus of claim 33 wherein said beam-focuser comprises at least one
2 focusing lens.
- 1 35. A method of optical spectral power monitoring using a polarization diversity scheme,
2 comprising:
3 a) providing a multi-wavelength optical signal;
4 b) decomposing said multi-wavelength optical signal into first and second
5 polarization components;

- 6 c) rotating a polarization of said second polarization component by
7 approximately 90-degrees;
8 d) separating said first and second polarization components by wavelength
9 respectively into first and second sets of optical beams; and
10 e) impinging said first and second sets of optical beams onto an array of optical
11 power sensors.

1 36. The method of claim 35 further comprising the step of rotating a polarization of said
2 second set of optical beams each by approximately 90-degrees, prior to impinging
3 onto said array of optical power sensors.

1 37. The method of claim 35 further comprising the step of rotating a polarization of said
2 first set of optical beams each by approximately 90-degrees, prior to impinging onto
3 said array of optical power sensors.

1 38. The method of claim 35 further comprising the step of modulating said first and
2 second sets of optical beams, respectively.

1 39. The method of claim 38 wherein said first and second sets of optical beams are
2 modulated to impinge onto an array of optical power sensors in a time-division-
3 multiplexed sequence.

1 40. The method of claim 38 wherein said first and second sets of optical beams are
2 modulated to carry distinct dither modulation signals, upon impinging onto said array
3 of optical power sensors.

1 41. The method of claim 40 further comprising the step of performing synchronous
2 detection of said dither modulation signals.

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